International Money and Banking: 16. The Taylor Rule

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Spring 2017

How Do Central Banks Choose the Right Interest Rate?

- We have covered a lot of material that helps explain roughly how modern central banks should behave: expectations-augmented Phillips curves, commitment and credibility, various central bank constitutions, and so on.
- But this doesn't address the basic operational question: How should a central bank decide what is the right interest rate to set at any point in time?
- In this lecture, we discuss a famous "rule" for monetary policy, first discussed in a 1993 paper by Stanford economist John Taylor.
- Much of the discussion of monetary policy today uses the so-called Taylor rule as a benchmark for how policy should be conducted.
- We will describe the rule and how it would be implemented, discuss how well it explains actual policy as well as its relevance to current US monetary policy.

What Is the Taylor Rule?

- Taylor suggested that a good rule for setting monetary policy was to make the money market interest rate (the federal funds rate in the US) a positive function of both inflation and the output gap, i.e. the gap between output and its long-run potential, non-inflationary, level.
- Algebraically, this can be written as

$$i_t = \alpha + \beta_\pi (\pi_t - \pi^*) + \beta_y (y_t - y_t^*)$$

  where i_t is the short-term interest rate, π_t is the inflation rate and π^* is the target rate of inflation, y_t is GDP and y_t^* is potential non-inflationary level of output.
- Note also that α determines the real interest rate prevailing when output and inflation are at target levels ($r^* = i^* - \pi^* = \alpha - \pi^*$).
- Is the second part of the rule—reacting to output gaps—inconsistent with commitment to low inflation? Not necessarily. A central bank with a focus on inflation may cut rates when output gaps are negative because recession reduces inflation.

What Coefficients for the Taylor Rule?

- There is widespread agreement that this type of policy rule should help to stabilize the economy and achieve a low target rate of inflation.
- But there is less agreement about the coefficients. How aggressive should the central bank be in reacting to inflation and reacting to output gaps?
- The answer to this question will reflect the preferences of the central bankers or their legal mandate.
- Central Banks are often described as having preferences of the form of a "loss function" such that they want to minimize

$$L = (\pi - \pi^*)^2 + \lambda (y - y^*)^2$$

  and different central banks may have different values for λ.
- Generally, those with a high λ—a high aversion to output volatility—will react more to output gaps and less to inflation.

The Taylor Principle

- So there is no precise agreement on exactly what specific coefficients the Taylor rule should have.
- However, there is a wide agreement on a principle put forward in Taylor's paper: β_π should be greater than one. This idea is now known as the Taylor Principle.
- Meeting this condition ensures that increases in inflation lead to higher *real* interest rates. If this is not the case, increases in inflation will stimulate the economy and perhaps further increase inflation.
- Taylor's original rule suggested $\beta_\pi = 1.5$ and $\beta_y = 0.5$.
- Econometric estimates of Taylor rule coefficients showed that his rule described the behavior of the Volcker and Greenspan Fed (i.e. the post-1979 Fed) quite well.
- However, the pre-Volcker Fed does not seem to have obeyed the Taylor principle. Econometric estimates show $\beta_\pi < 1$ for these years.
- This lack of responsiveness of policy to inflation helps to explain why inflation got so high during the 1970s.

Operational Issues

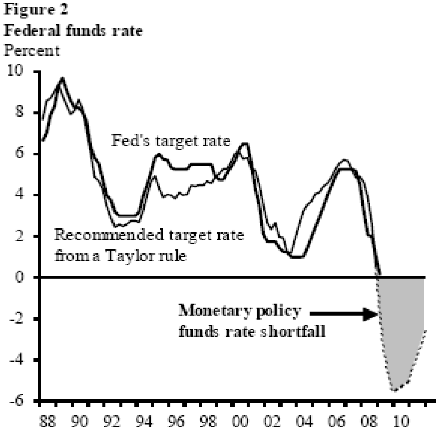
Taylor rules require some subtle decisions before they can be operational:

1. Inflation:
   - What is the relevant price index? All goods and services (GDP deflator) or consumer prices?
   - Total or core inflation? Include volatile components should as food and energy? (Argument for total: People need to purchase food and energy. Argument for core: Why should policy respond to volatile temporary changes?)
   - What is the target inflation rate? 2% is popular, but why? (Some believe official measures overstate inflation by missing quality improvements; also want to avoid deflation.)
2. Output gap:
   - Potential output usually assumed to evolve smoothly.
   - Usually measured as the trend value of output, for instance as fitted value from regressing real GDP on a time trend.
   - Could also be measured using the unemployment rate or an estimated gap between unemployment and the natural rate.

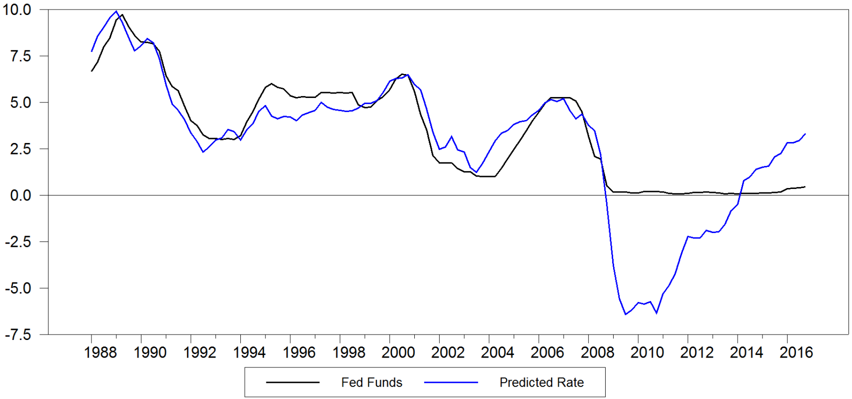
The Taylor Rule and the Lower Bound

- What happens when the Taylor rule tells the central bank that its target interest rate should be negative? As we've discussed before, there are limits to how far central banks can push interest rates.
- Is this relevant? In May 2009, Glenn Rudebusch of the Federal Reserve Bank of San Francisco published a paper with a version of an estimated Taylor rule—one whose coefficients are estimated from a regression—using core consumer prices to measure inflation and an unemployment gap to proxy for the output gap. It suggested Taylor rules implied negative fed funds rates would be required from summer 2009 on based on the Fed's macro forecasts.
- The next page shows Rudebusch's graph while the page after shows my updating of the graph. The update suggests that the Taylor rule rate turned positive over the past year. This shows that the zero bound was very relevant over the past decade but also suggests the Fed has been slower to raise rates than the rule predicted.
- These estimates are a bit controversial. Taylor has taken issue with this version of "his" rule, preferring rules that predicted low positive rates. However, the Fed is known to follow the core inflation rate closely and the unemployment gap used here seems reasonable.

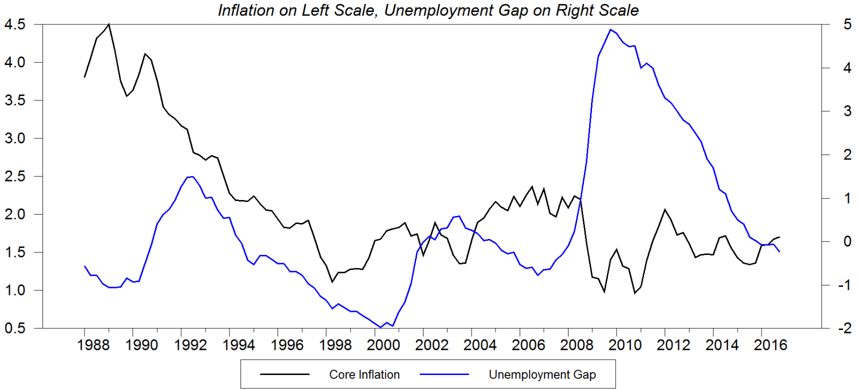
Glenn Rudebusch's Estimated Taylor Rule



An Update of Rudebusch's Graph



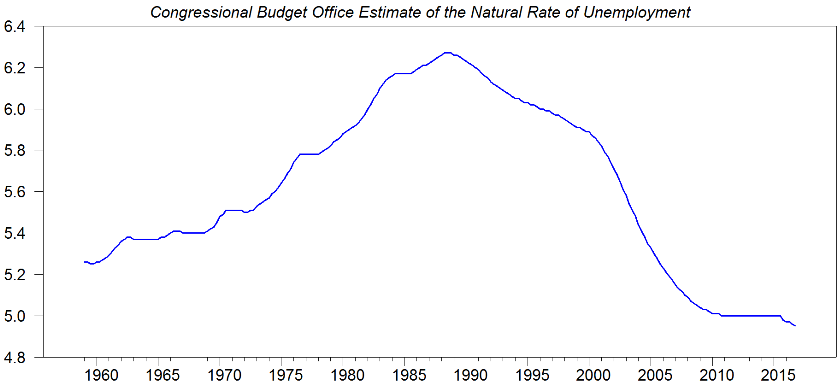
Inputs into the Rudebusch Taylor Rule



Disadvantages of a Taylor Rule? Output Gap Uncertainty

- One important argument against Taylor rules has focused on its reliance on estimates of output gaps: Potential GDP is not actually known, and attempts to estimate it are not very reliable.
- In the Rudebusch version of the rule, there is uncertainty about the natural rate of unemployment. He uses an estimate from the Congressional Budget Office.
- Former Fed economist, Athanasios Orphanides has argued that a reliance on output gap estimates has caused trouble in the past:
  1. During the 1970s, growth rates for major international economies slowed considerably. Policy-makers thought their economies were falling far short of its potential level. In retrospect it is clear that potential output growth rates were falling and true output gaps were small.
  2. Thus, policy was still stimulating the economy when it should have been focused on getting inflation down.
  3. Orphanides also pointed out that the real-time data on GDP that policy makers use are often substantially revised when more data arrive in later. So it is always hard to guess where output is relative to potential.

The CBO's Estimate of Natural Rate



Disadvantages of a Taylor Rule? Equilibrium Real Rates

- Remember that the coefficient α determines the equilibrium real interest rate, i.e. the interest rate that would prevail if $\pi_t = \pi^*$ and $y_t = y_t^*$. In this case, the real interest rate is $r^* = \alpha - \pi^*$.
- Is the equilibrium real interest rate constant over time? Probably not.
- Fast-growing economies in which there are lots of profitable investment opportunities probably require a higher real interest rate on average then slow-growing economies.
- Japan during the 1990s was an example of an economy stuck in a slow-growing slump period. With very low returns on capital investment projects, real interest rates had to be very low to make borrowing for capital expenditures worthwhile.
- So, even after settling on the right inflation target and an estimate of the output gap, central bankers still need to use other information to assess whether they have set the real interest rate at about the right levels.

Recap: Key Points from Part 16

Things you need to understand from these notes.

1. What is the Taylor rule?
2. How might Taylor rule coefficients reflect policy-maker preferences?
3. The Taylor principle.
4. Decisions required to operationalise the Taylor rule.
5. Implications of the zero bound for implementing the Taylor rule.
6. Implications of uncertainty about the output gap.
7. Implications of uncertainty about the equilibrium real rate.